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Migrating the CMM Wizard to a Robust and Accessible ASP.NET Format

Alexander E. Booth, Jeremy Rishel, Cliff Glantz, and Xiao-Ying Yu

Pacific Northwest NATIONAL LABORATORY

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Introduction

- The Chemical Mixture Methodology (CMM) provides default emergency exposure guidelines for mixtures of chemicals. The CMM makes realistic but not overly conservative predictions about health risks from chemical mixtures.
- The CMM is currently offered in an Excel workbook format, although an alpha version web application CMM Wizard was developed in ASP in 2010.
- We report the development of an ASP.NET beta version of the CMM Wizard which offers new features and upgrades to CMM Wizard Alpha.

Background

CMM Method

1. Input chemicals by CASRN, receptor distance, concentration, and PAC concentration limit to calculate Health Index (HI) given by

$$HI = \frac{Concentration \quad @\,Receptor}{PAC\ Value}.$$

2. HIs are summed for all chemicals, and by mode/target organ, respectively.
3. The sums of the HIs for all of the chemicals and for each mode and target organ toxic effect are provided.

CMM Workbook

- Macro-enabled Excel workbook
- Built-in database worksheet
- Pros/Cons
  - \+ Fast mode of consequence assessment
  - \+ By Mode/Target Organ breakdown for emergency preparedness
  - – Only calculates results for one receptor, and one PAC level at a time
  - – Excel inflexible in input/output

CMM Wizard Alpha

- ASP web application
- Separate Access database
- Pros/Cons
  - \+ Wizard format easy to navigate
  - \+ Flexible inputs—search and list
  - – Still only one receptor and PAC at a time
  - – CMM logic inextricable from html display markup/logic
  - – ASP no longer state of the art

CMM Wizard Beta

- New ASP.NET web application
- Same Access database as CMM Wizard Alpha

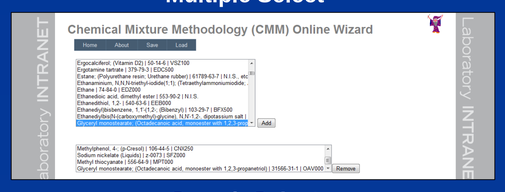
Why ASP.NET?

- ASP.NET state of the art
- Allows for modularized coding—separation of CMM and display logic
- Specific .NET Framework functions available for dealing with Access database
- Microsoft Visual Studio ideal for rapid application development and debugging

New Features/Improvements

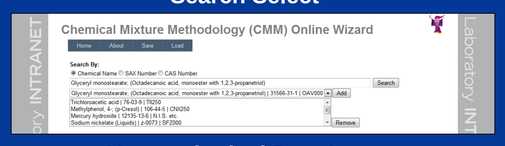
- **Chemical Input**
  - Multiple and Search select
  - Add/Remove chemicals

Multiple Select

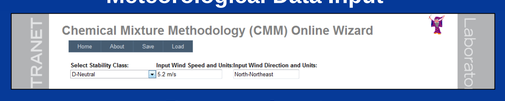


- **Meteorological Data Input**
  - Differentiates data sets

Search Select

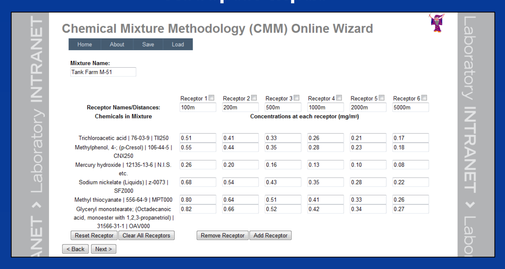


Meteorological Data Input

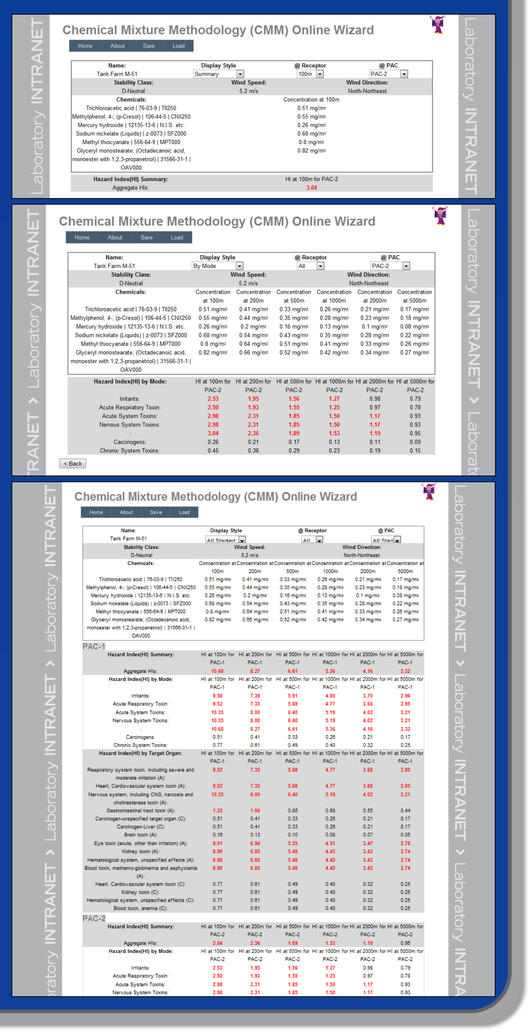


- **Receptor Input**
  - Maximum 6 receptors
  - Name receptors
  - Add, Remove, Reset, Clear functions

Receptor Input



- **Output Interface**
  - **Report Items**
    - Mix Name
    - Display Mode
    - Met. Data
    - Chemicals
    - Receptors
  - **Display mode**
    - Summary
    - By mode
    - By target organ
    - All at once
  - **Receptors**
    - Any one
    - All at once
  - **PAC**
    - Any one
    - All at once
  - **Printing**
    - Built into browser



ASP.NET Benefits

- ASP.NET written using VB.NET instead of the limited functionality VBA and VBScript Languages
- .NET Framework provides functions for reading/writing files and many other complex tasks
- ASP.NET simplifies creating displays and dynamically changing them
- ASP.NET built for creating sites that implement databases of user accounts (necessary for future work)
- ASP.NET has extensive support and reference communities

Future Work

Short-Term

- Allow users to save or load their sessions as CMM files
- Create display for seeing HI values broken down by mode or target organ for individual chemicals
- Add specific instructions to each step to help avoid user confusion

Long-Term

- Integrate the CMM logic into other emergency response and software (i.e. HARM, EpiCode, or ALOHA).
- Create an interface for updating the CMM database as new information develops.

References

1. Yu, Xiao-Ying et al. (2010), The development of the chemical mixture methodology in analysis of potential health impacts from airborne release in emergencies, *J. Appl. Toxicol., 30*, 513-524.
2. Subcommittee on Consequence assessment and Protective Actions—Emergency Management Issues Special Interest Group, Chemical Mixture Methodology (CMM), available from http://orise.orau.gov/emi/scapa/chem-mixture-methodology/default.htm.

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Contact Information

Alex Booth -- aeastwoodbooth@gmail.com
Xiao-Ying Yu -- xiaoying.yu@pnnl.gov

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